Vol. 100 No. 13 December 25, 1943

The American FERTILIZER

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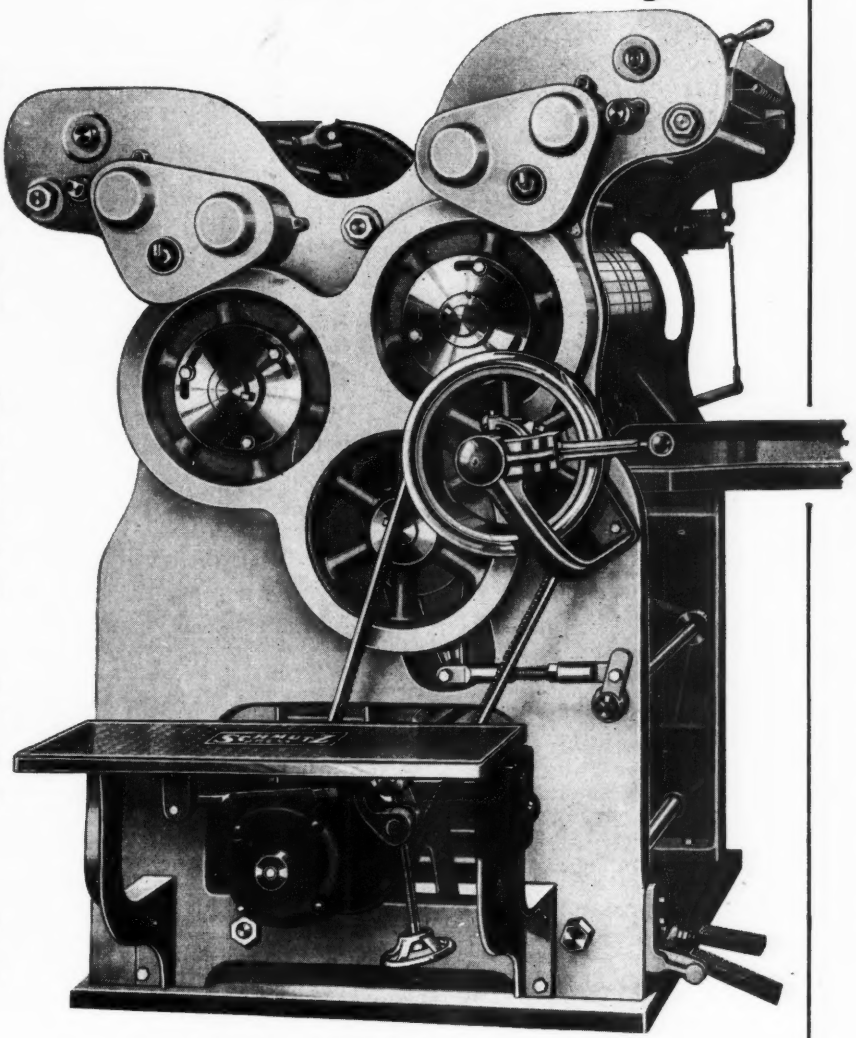

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The American FERTILIZER

Vol. 109 DECEMBER 25, 1948 No. 13

The Fate of Phosphate Soil Supplements

By JACKSON B. HESTER

AUTHORITIES agree that one of the keystones of crop production revolves around the presence of readily available phosphorus in the soil. There is available in the world phosphorus deposits in concentrated forms sufficient to last for more than 1,000 years for agricultural uses. This phosphorus has been deposited in a relatively insoluble state and has to be processed for agricultural use. Under average conditions many crops suffer from the lack of available phosphorus. Soil conditions (*1, 3, 4, 7*)** influence, to a great degree, the availability of phosphorus to the plant. For, after all, although every living cell requires phosphorus, relatively small amounts supply the cells for normal growth.

There are seven general conditions in the soil that influence the availability of phosphate soil supplements. These conditions are, namely, the amount and composition of clay, the amount and composition of organic matter, soil reaction and replaceable bases, drainage and microbiological activity, time and temperature, the amount and composition of phosphate supplements, and crop rotation and test crop used.

Amount and Composition of Clay

Soils vary tremendously in the amount and composition of clay found in them (*16, 20*). The Ap horizon of the soil represents that soil normally cultivated in crop production. The B horizon represents the accumulated horizon, or that horizon under the plowed surface soil that accumulates clay and plant nutrients leached from the cultivated soil.

Soils of the United States have been divided (*16*) into podzols, gray and brown podzolic soils, red and yellow soils, prairie soils and other classifications. However, the above soils are in the areas where commercial fertilizers are more largely used. Calculations of tons of clay (*16*) per acre in the A_p and B horizons have been made. While the variations are very great, the mean figures shown in Table I represent, to a degree, the amount of clay in the soil that may influence the availability of the added phosphorus. By and large, the amount of clay increases from the podzols to the prairie soils. From these figures it is evident that the soil has tremendous power to absorb and finally fix phosphorus in a difficultly available state. It must be remembered that although the amount of clay is an important factor in the fixation of phosphorus in an unavailable state, there are other factors that are extremely important.

It has been shown that the composition of the clay is a very potent factor in the fixation of phosphorus in a difficultly available state in the soil (*11, 15, 17, 18, 19, 21, 22*). A prime factor in this relation is the silica-sesquioxide ratio. The figures in Table II show that as we go from the podzols to the lateritic types of soil, the molecular ratio of aluminum and iron to silica decreases. This means that the clay content of the soils in the warmer sections is higher in iron and aluminum in pro-

*Soil Technologist, Campbell Soup Co., Riverton, N. J. Presented before the Fertilizer Division of the American Chemical Society, September, 1948.

**See references at end of paper.

portion to silicic acid than in the colder sections.

Soil colloids are weak ampholytes in which silicic acid and organic matter represent the acid nature of the colloid and aluminum and iron sesquioxides represent the basic nature of the colloid. The colloids may then be divided into three categories, namely, the montmorillonite types of clay (*17*) or those in which the silica-sesquioxide molecular ratio is about 3, the podzolic types in which the silica-sesquioxide molecular ratio is near 2, and the lateritic types in which the ratio is less than 0.5.

The prairie soils are characterized by the montmorillonitic types of clay, while the podzolic and lateritic soils are characterized by the kaolinitic types of clay. See Figure I.

Kaolinite: $Al_2Si_2O_5(OH)_4$

Montmorillonite: $(Al\ Mg)_8(Si_4O_{10})_3(OH)_{10}\cdot 12\ H_2O$

Montmorillonite Found in Soil: $Al_{1.50}Fe_{0.14}Mg_{0.2}{}^{+3}{}^{Ca_{0.17}}(Al_{0.09}Si_{3.91})O_{10}(OH)_2$

Fig. 1. Composition of types of clay.

Considerable work has been done on the influence of the various conditions of the availability of phosphates. The illustration in Table III shows the relation of the different groups of soil upon the fixation of phosphates. It is obvious from investigations (*6*, *7*, *8*, *12*, *18*, *19*) that as the amount of iron and aluminum increases, the amount of P_2O_5 absorbed by the clay increases. Given three types of clay of this same nature with an equal amount of organic matter, the availability of phosphates to certain plants would undoubtedly

TABLE II

THE MOLECULAR RATIO OF IRON, ALUMINUM, AND SILICA IN THE CLAY OF VARIOUS SOIL GROUPS*

Number	Molecular Ratio			
	A		B	
Soils	SiO_2/Al_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	SiO_2/Fe_2O_3
	Podzol Soils			
3.....	3.82	20.35	2.46	6.35
	Prairie Soils			
9.....	3.33	14.18	3.25	11.13
	Gray Brown Podzolic Soils			
4.....	2.74	10.63	2.77	9.79
	Yellow Soils			
14.....	2.23	8.56	2.46	9.37
	Red Soils			
8.....	1.74	9.75	1.64	7.47
	Lateritic Soils			
5.....	2.29	8.43	2.17	7.30
	Laterites			
2.....	1.05	2.14	0.92	1.94

*Mean

TABLE III

VARIATION IN THE SILICA-SESQUIOXIDE RATIO OF THREE SOIL GROUPS

	Montmorillonitic Type	Podzolic Type	Laterite
$\frac{SiO_2}{R_2O_3}$	3.18	1.89	0.31
Mgs. P_2O_5 Absorbed/g.	1.0	2.9	16.8

TABLE I

THE AMOUNT OF CLAY FOUND IN VARIOUS SOIL GROUPS*

Number Soils	Tons Per Acre						
	Ap				B		
	Mean	Variation			Mean	Variation	
	Podzol Soils						
5.....	184,967	61,500	—	430,667	603,300	116,000	— 960,000
	Prairie Soils						
10.....	1,604,700	572,000	—	2,960,000	2,512,000	1,164,000	— 3,912,000
	Gray Brown Podzolic Soils						
27.....	600,214	97,333	—	1,930,000	1,634,214	50,000	— 3,984,000
	Red and Yellow Soils						
43.....	415,023	35,000	—	1,974,000	4,182,129	58,667	— 12,168,000

*Mean

be in the reverse relation. However, the situation is complicated by the amount of organic matter in the soil.

Amount and Composition of Organic Matter

Organic matter exists in the soil in two general forms: that which is immediately added to the soil and is undergoing decomposition; and that which has already undergone decomposition and reached the state of arrest. The latter type of organic matter is that largely found in the soil. The illustration in Table IV shows the relation of three different soil groups and organic matter. In other

TABLE IV

THE DISTRIBUTION OF ORGANIC MATTER IN RELATION TO SOIL GROUPS

Per cent Organic Matter	Montmorillonitic Type	Podzolic Type	Lateritic Type
– 1.9	0	60	72
2.0 – 3.9	0	40	28
4.0 – 4.9	6	0	0
5.0 – 6.9	53	0	0
7.0 –	40	0	0

words, the montmorillonitic types contain much more organic matter than the podzolic and lateritic types of clay (*3*). This is a factor associated with the amount of clay in the soil and the temperature under which the soil is developed; that is, the more clay in the soil, the more organic matter is likely to be found because of the union of organic matter with the clay and also the higher the temperature, the less organic matter is to be found because of the effect of higher temperatures on the decomposition of organic matter. Consequently, the silica-sesquioxide ratio and the amount of clay in relation to the availability of added phosphorus is complicated by the amount of organic matter in the soil as well as soil reaction and replaceable bases.

Soil Reaction and Replaceable Bases

The soil reaction and replaceable bases of the various soils vary tremendously. By and large, the soils of the podzolic zone are lighter in texture, that is, carry the least amount of clay in proportion to other soil groups, and for that reason carry less replaceable bases. Owing to the heavy rainfall which these soils receive, the bases are largely removed from the surface soil and the *p*H is low.

Data given in Table V show that the amount of replaceable bases in the podzolic soils is low. Furthermore, these data show that the available phosphorus to tomatoes under the conditions of the virgin soil is extremely low. These experiments were conducted under similar conditions in pot culture work in which 7,000 grams of subsoil and 7,000 grams of top soil were used (*10*). These data show that the soil reaction or *p*H value and the replaceable bases are important factors in the available phosphorus to a crop like tomatoes since the amount of phosphorus added in each case was identical, yet the amount of phosphorus absorbed by the tomatoes on the acid soils was much less than on soils more nearly neutral. However, these data also show that where the replaceable bases (calcium and magnesium) were higher,

(Continued on page 24)

TABLE V

INFLUENCE OF SOIL REACTION AND REPLACEABLE BASES UPON THE AVAILABILITY OF PHOSPHORUS TO TOMATOES

Soil pH	Replaceable m. e./7000 g. soil Ca	Mg	K	Grams G. Wt. Fruit	Grams D. Wt. Fruit	M. E. P. Absorbed by fruit
			PODZOLIC TYPE SOILS			
4.6	77	36	203	337.2	21.1	8.5
6.7	577	536	203	819.0	51.4	19.0
			RED AND YELLOW SOILS			
5.05	264	72	201	866.5	53.6	18.4
6.25	964	772	201	916.0	59.1	22.1
			PRAIRIE SOILS			
7.0	1180	92	323	971.5	59.3	20.7
6.1*	1180	92	323	588.0	34.7	13.2
6.2	1309	80	237	1585.5	84.0	35.3
4.0*	1309	80	237	1085.5	69.5	24.3

*Fertilizer and sulfur instead of fertilizer and lime.

Army Allocates More Anhydrous Ammonia

The Office of Domestic Commerce announced on December 23rd the allocation of 4,888 tons of anhydrous ammonia from army ordnance plants to three fertilizer plants which otherwise would be forced to suspend or curtail operation for lack of this material during the first three months of 1949.

The quantity made available to each of the companies represents the minimum of anhydrous ammonia required to keep each plant in production of ammonium sulphate. The allocation amounts to 4,025 tons in terms of nitrogen content and will require the use of 188 tankcars.

Companies to which the allocations were made are Farm Service Company, Oakland, Calif.; A. F. Pringle and Company, Charleston, S. C., and Columbia Metals Company, Seattle, Wash.

Officials of the chemicals division of the ODC said that after providing for these preference cases, approximately 372 tankcar loads of Army anhydrous ammonia remain to be distributed among domestic fertilizer producers during the first quarter of the new year. This is being distributed in proportion to the participation of the recipient company in the civilian export program. It has been allotted to the following eligible producers:

Barrett Division, Allied Chemical & Dye Corporation; Commercial Solvents Corporation; E. I. du Pont de Nemours & Company; Lion Oil Company; Mathieson Chemical Corporation; Spencer Chemical Company, and the Tennessee Valley Authority.

October Superphosphate Production

During October, production of superphosphate at 181 plants in the United States totaled 831,000 equivalent short tons (basis 18% A.P.A.), according to reports submitted by manufacturers to The National Fertilizer Association and a summary of reports submitted to the Bureau of the Census. Compared with last October, production was off 7 per cent. This is the third time so far this year that monthly production has been below that of the corresponding month in 1947. Despite the decreased production, total supply for the month was 28 per cent greater than for October 1947. Compared with that period, shipments were fractionally higher, but the amount of superphosphate used in mixed goods was down 4 per cent; stocks at the end of the month, totaling 1,363,000 tons, were substantially above those for October 31, 1947. During the month, production of normal superphosphate, amounting to 713,000 tons (18% APA), comprised 86 per cent of total production—the tonnage reported for concentrated superphosphate, converted to an 18 per cent basis, represented over 13 per cent of the total, while wet base goods made up the remainder.

Total equivalent production during January-October, amounting to 8,877,000 tons (18% APA), was 5 per cent greater than for the corresponding period last year. Compared with that period, shipments increased 6 per cent, but use of superphosphate in mixed goods was off 4 per cent.

	Normal	Concentrated	Base Goods
Production	18% A.P.A.	45% A.P.A.	18% A.P.A.
October, 1948....	713,395	44,892	5,192
September, 1948..	685,636	44,924	3,980
October, 1947....	794,350	37,944	4,403
Shipments and Used in Producing Plants			
October, 1948....	780,149	39,321	4,519
September, 1948..	725,535	40,812	2,089
October, 1947....	799,342	37,842	3,334
Stocks on Hand			
Oct. 31, 1948.....	1,155,046	78,976	10,778
Sept. 30, 1948....	1,213,040	73,405	10,090
Oct. 31, 1947.....	690,099	63,233	15,225

October Sulphate of Ammonia

Production of by-product sulphate of ammonia increased during October to a total of 71,002 tons, according to the figures of the U. S. Bureau of Mines. In addition the reporting plants manufactured 3,065 tons from purchased synthetic ammonia. The increase in by-product sulphate corresponded with the slightly longer month, so that there was no encouragement that the ammonia shortage had been improved. Shipments during October were slightly above production figures and consequently stocks on hand totaled only 24,476 tons at the end of the month.

	Sulphate of Ammonia	Ammonia Liquor
Production	Tons	Tons NH_3
October, 1948.....	71,002	2,186
September, 1948.....	69,860	2,073
October, 1947.....	71,457	2,189
Jan.–Oct., 1948.....	685,852	20,507
Jan.–Oct., 1947.....	667,375	21,401
Shipments		
October, 1948.....	73,023	1,416
September, 1948.....	73,133	1,436
October, 1947.....	67,853	1,916
Stocks on hand		
October, 31, 1948.....	24,476	582
September 30, 1948.....	26,583	503
October, 31, 1947.....	30,440	757

The TVA and the Fertilizer Industry*

By GORDON R. CLAPP

Chairman of the Board, Tennessee Valley Authorities

(Continued from the issue of December 11, 1948)

3. *Research and Experiment in New Processes of Production and New Fertilizer Products Point the Way to Greater Supply for Greater Markets*

Behind the new fertilizer materials supplied by TVA to the test-demonstration farmers and their neighbors is a program of chemical research and experimental manufacture. In the reconstructed and improved nitrate plants built at Mussel Shoals during World War I—plants that did yeoman service in supplying munitions in World War II—TVA is carrying on research in the development of new processes and new fertilizer products. As one of its objectives, this research is designed to help you or anyone else open up the great undeveloped phosphate deposits of the West.

There is a shortage of phosphate fertilizer now—gauged by what the farmer is willing and able to buy. Figures released in February 1947 by the Production and Marketing Administration compare phosphate consumption with our estimated annual needs in the United States. These figures show that the average annual consumption was about 700,000 tons of P_2O_5 during the pre-war period 1935–39. During the war years of 1944–45 the figure jumped to nearly 1,340,000 tons. But that, according to the U. S. D. A. and the land-grant colleges, was only about half what the farmers could have used effectively if they had been able to buy as much as they needed. This estimate—nearly 3,000,000 tons of P_2O_5—was based largely on the experience of TVA test-demonstration farmers, who have led the way in the consumption of commercial fertilizer.

Many agriculturists consider this estimate of the phosphate requirement to be a very conservative goal. If the experience of the most successful of the TVA test-demonstration farmers had been used as a standard of potential profitable use, it would have been necessary to double the estimate at the very least. *And even that total does not represent the true need of our soils for phosphate and other fertilizer materials if we are to protect our watersheds and operate our agriculture at a sustained high level of productivity and efficiency.*

As I am sure all of you understand, TVA's fertilizer research is a balanced operation, necessarily concerned with both fertilizer use and fertilizer production—the development of new processes and products. One research supplements the other. The recorded experience of thousands of test-demonstration farmers helps to set production research targets. It tells the chemists and engineers the kinds of fertilizers they should try to develop to serve the present and future needs of the farmer and his soil.

You know from your long experience that important new fertilizer uses are emerging out of the experience of farmers throughout the nation. I have mentioned the growing use of mineral fertilizers as a means of helping the farmer shift land use in the South and elsewhere; large amounts of phosphate especially are required to change from summer row crops to winter sod crops. There is also a steadily expanding market for fertilizer in irrigated agriculture.

Middle West Market

Of these new markets, the most important, probably, is the expanding fertilizer need of the nation's breadbasket—the 12 states of the Central and Middle West that grow 60 per cent of the nation's total production of food. In the past these states have not used much fertilizer, but they are using more now and they would use a lot more if they could get it.

During the war and postwar years middle western farmers discovered that the natural fertility of their soils was declining and that it paid to fertilize. Phosphate consumption increased fourfold, fivefold, sevenfold, in the principal states of the nation's breadbasket, and still the demand is far from satisfied. Over 25 per cent of that phosphate is coming from Tennessee, which today holds only about 1 per cent of our national phosphate supply. The great western phosphate deposits, representing nearly 70 per cent of the nation's total, have been supplying only 5 per cent of the

(Continued on page 26)

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Principal Articles in This Issue

Agricultural Research with Radioactive Chemicals Expanded

Extensive new programs of research in soil and plant science will be carried on under arrangements concluded by the U. S. Department of Agriculture and the U. S. Atomic Energy Commission. The programs will center in new facilities, such as greenhouses and "hot" laboratories for handling radioactive chemicals, to be constructed by the Energy Commission at the Plant Industry Station of the Department at Beltsville, Md. Soil and plant scientists on the staff of the Bureau of Plant Industry, Soils, and Agricultural Engineering will carry on the studies.

One group of studies is aimed to give aid in the safe disposal of liquid radioactive wastes at installations of the atomic energy program by ascertaining exactly how radioactive elements behave when introduced into soils. Facts will be sought on the movement, the fixation, and the release of various radioactive substances in various soil types.

These studies are expected to result in new and more precise knowledge which will bear on how and when to plow and cultivate and fertilize for best results with different crops on different soil types.

Other purposes of the work to be carried on under the agreement include:

1. Development of procedures for safe and effective use of radioactive isotopes in soil and crop research.

2. Supplying for use by other agricultural research agencies fertilizers incorporating radioactive trace elements.

3. Developing in the U. S. Department of Agriculture and cooperating State agricultural experiment stations a group of scientists skilled in the use of isotopes in soil and crop research.

In the fundamental soil research the scientists will study the mechanism by which nutrients in soil are released and transferred to plants. They will make similar studies of fertilizer and liming materials added to the soil. Much of this work will be with the so-called secondary and minor or trace elements —cobalt, molybdenum, copper, manganese, etc. Biochemical investigations are intended to throw light on the part that various chemical elements play in growth of plants, how plants take up nutrients from the soil, the relation between the chemical composition of plants and the soil in which they grow, or of fertilizers used on the soil.

The Bureau of Plant Industry, Soils, and Agricultural Engineering will provide an area

at the station on which the special facilities, to cost about $200,000, will be constructed. The facilities will include a greenhouse and a headhouse with a full basement containing constant-environment growth rooms. The headhouse will have so-called "hot" laboratories designed for handling radioactive isotopes. There will also be improved facilities for the manufacture of radioactive fertilizers, soil amendments such as lime and related materials. Adjacent to the greenhouse will be lysimeters for use in the study of the movement of radioactive materials in the soils. Soil frames will be available for small-scale field experiments.

The improved facilities for the manufacture of radioactive fertilizers and soil amendments will be used to produce those materials for State agricultural experiment stations and other research agencies. The Bureau has done this on a limited scale during the past year but can increase production when the new facilities are completed.

It is expected that arrangements will be made with the Graduate School of the Department of Agriculture whereby graduate students may receive training at the Plant Industry Station in the use of radioactive isotopes. Likewise, arrangements will be made for staff members of other agricultural research agencies to obtain experience on the project at Beltsville.

Link-Belt Promotes Whinrey and Heinlein

Link-Belt Company announces that R. E. Whinrey, formerly superintendent, has been appointed to the newly created position of assistant general manager of the Link-Belt Dodge plant in Indianapolis; and that L. C. Heinlein, formerly assistant superintendent, has been appointed superintendent of this plant.

The Dodge plant is devoted to the manufacture of Link-Belt ball and roller bearings of both mounted and unmounted types.

Mr. Whinrey entered the estimating department of the Dodge plant in 1925, upon graduation from Purdue University in mechanical engineering. He successively was foreman of the heat-treating department; head of time study and rate setting; assistant superintendent, and had been superintendent since 1940.

Mr. Heinlein entered the employ of the Dodge plant in 1926, upon graduation from Purdue in mechanical engineering. He first worked in the various departments of the shop to gain shop experience. He then successively served in the experimental department, shop maintenance department, research and development, the Dodge plant laboratory, the engineering department, and has been assistant superintendent of the Dodge plant for the last year.

Doane Elected Vice-President of International Paper

At a meeting of International Paper Company directors, John H. Hinman, President, announced that Richard C. Doane had been elected Vice-President in charge of sales. He stated that Mr. Doane was returning to New York from Montreal and was resigning as Vice-President and General Manager of Canadian International Paper Company.

Mr. Doane joined the International Paper Company sales department in 1924 and became Assistant to the Sales Manager in the next year. In 1928 he was appointed Manager of the Newsprint Division and in 1929 Vice-President of International Paper Sales Company, Inc. In 1938 he moved to Montreal, and in 1941 was elected President of the Sales Company. He was also a Vice-President and a Director of Canadian International Paper Company and in 1947 was appointed General Manager.

Potash Institute Publishes New Book on Diagnosis

The American Potash Institute has recently published a new book entitled "Diagnostic Techniques for Soils and Crops" which brings up-to-date the work which has been done in determining the nutrient needs for soils and crops.

Following a historical introduction which reviews the methods in use during the past three centuries, the succeeding eight chapters cover such subjects as chemical methods for assessing soil fertility, comparison of soil tests with fertilizer experiment results, the state soil testing services, plant tissue tests, visual symptoms of malnutrition in plants. Each chapter has been prepared by a leading scientist in that particular field.

This volume of 332 pages is fully illustrated with photographs (5 in color) and with drawings. It will be a valuable addition to the library of every fertilizer plant as well as of every worker in the field of plant nutrition. The price of this book is set at $2.00 per copy, postpaid, and can be obtained from the American Potash Institute, 1155 16th St., N.W., Washington 6, D.C.

Fertilizer Application Committee Publishes Recommendations

The National Joint Committee on Fertilizer Application, which is composed of representatives of the National Fertilizer Association, the American Society of Agronomy, the American Society of Agricultural Engineers, the American Society for Horticultural Science, the Farm Equipment Institute, and the National Canners Association, has issued a 28-page booklet entitled "Methods of Applying Fertilizer" which give the recommendations revised to November, 1948.

All of the principal field and vegetable crops are included in these recommendations, as well as for orchards and nuts. A portion of the report is devoted to the application of liquid fertilizers in irrigation water, in starter solutions and in direct application of anhydrous ammonia and other solutions.

The booklet has been published as Pamphlet No. 149 by the National Fertilizer Association.

Commercial Solvents Names New Directors

Austin S. Igleheart, president of General Foods Corporation, and Harold H. Helm, president of the Chemical Bank and Trust Company, have been elected to the Board of Directors of Commercial Solvents Corporation, it has been announced by Major Theodore P. Walker, Chairman of the Board.

Mr. Igleheart was first associated with Igleheart Brothers, Inc., which, in 1926, joined General Foods. Elected General Foods Vice-President in Charge of Manufacturing and Transportation in 1929, he became successively Vice-President in Charge of Sales and Executive Vice-President. In 1943, Mr. Igleheart became President of General Foods.

Mr. Igleheart is also a director of Grocery Manufacturers of America, National Association of Manufacturers, Chase National Bank, and Chicago and Eastern Illinois Railroad.

Mr. Helm, after graduating from Princeton in 1920, joined the Chemical National Bank which later changed its name to the Chemical Bank and Trust Company. He became Vice-President in 1929, a director in 1941, First Vice-President in 1946, and President in 1947.

Mr. Helm is also a director of Corn Products Refining Company, The Home Insurance Company, City Investing Company, Cedar-Temple Realty Corporation, and Phelan Realty Corporation.

Ladino Clover Good Orchard Cover

Early spring is the best time to start a Ladino clover sod in the apple orchard, according to Carl S. Bittner of Pennsylvania State College. The first consideration in seeding the legume, he advises, is to meet lime requirements, working the lime into the existing sod with heavy discing and harrowing. About 400 pounds of 0–20–20 fertilizer, or its equivalent, should be applied well ahead of seeding. This can be done with a fertilizer drill or a "whirl-a-gig." Such fertilizer applications can be repeated at intervals of three to four years. Enough nitrogen must also be applied yearly to keep the trees in vigorous growing condition, but once the Ladino is established, it will furnish the nitrogen needs. Bittner advises that Ladino should be seeded at the rate of one to two pounds per acre, depending upon the size of the trees. After it is established, it can be mowed several times a year and the clippings allowed to lie as they fall, or if preferred, the clippings can be rolled under the trees by side delivery rake and used as a mulch.

FERTILIZER MATERIALS MARKET

NEW YORK

Chemical Nitrogen Supply Still Short. End of Strike Aids Nitrate of Soda Imports. Crganics Show End-of-Year Slackness with Prices Easier. Some Resale Lots Being Offered. Superphosphate Shipments Increase with Start of Mixing Season. Potash Supply Improving.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, December 22, 1948.

Sulphate of Ammonia

Demand for this material continued excellent and shipments were being made against old contracts. Some material was shipped for export under Government direction.

Nitrate of Soda

With the end of the maritime strike, more normal shipments of this material are looked for but the demand continued excellent.

Nitrogen Solutions

Buyers still trying to obtain necessary supplies but production far short of demand.

Nitrogenous Tankage

Shipments were moving slowly to fertilizer manufacturers and while no particular price weakness was reported, the market is not as strong pricewise as it was a few months ago.

Castor Pomace

Some re-sale lots were reported available at slightly under regular contract prices, as demand in certain southern sections was said to be slow. Most producers are well sold up, however, and no great weakness is looked for.

Organics

With most feed buyers withdrawing from the market until about January 1st to take inventory, some packing house by-products had a tendency to ease off slightly in price. While most producers were well sold ahead and trading and offerings were light, the market on tankage and blood was considered to be about $9.50 per unit of ammonia ($11.55 per unit N), f.o.b. production points. At these prices fertilizer buyers were not buying, as other organic materials are selling at more attractive figures. Some re-sale lots of soybean meal came on the market and while the market was considered to be about $70 per ton in bulk, f.o.b. Decatur, Ill., resales were offered lower. Linseed meal was firm in price and a good many producers were sold ahead into March, with current prices around $70.00 per ton in bulk, f.o.b. Minneapolis.

Fish Meal

Some material for quick shipment was sold at $150.00 per ton, f.o.b. production points, with very little offered. Feed buyers were more active than fertilizer buyers at these prices. Some fish scrap was reported sold at $138.00 per ton, f.o.b. Atlantic Coast points.

Bone Meal

This material continued very scarce with the feed trade taking the bulk of the production and leaving very little bone meal available for the fertilizer trade. Some producers were sold ahead for 60 days and it is now feared there will be a shortage in the spring.

Hoof Meal

The market was considered to be $7.00 to $8.00 per unit of ammonia according to shipping point. A good demand continued due to the small production.

Superphosphate

The Government opened bids recently and received offers for a considerable tonnage from domestic producers, at varying prices. Shipments to fertilizer manufacturers have increased recently as more of the small mixers have started mixing operations. No price changes were reported.

Potash

Domestic producers continued to make shipments against regular contracts and while the supply situation was reported to be improving, the demand continued heavy from all areas. No new developments were reported in foreign potash.

PHILADELPHIA

Farmers Slow in Taking Fertlizer Supplies. Drop in Tonnage Expected. Nitrogen Still Short. Superphosphate and Potash Adequate.

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, December 20, 1948

Consumers are reported slow in ordering out their mixed fertilizers, and while nitrogen materials continue quite scarce there is somewhat of a lull in demand. It is expected that the quantity of fertilizer used this coming season will be less than last year, but the cost will very likely be more.

Sulphate of Ammonia.—The supply continues short of requirements, with production mostly under contract. Market position is definitely tight.

Nitrate of Soda.—Chilean shipments are arriving per schedule, with deliveries entirely on contracts. Demand is much ahead of the supply.

Ammonium Nitrate.—Though production shows some improvement, the demand is much in excess of the supply.

Blood, Tankage, Bone.—These organics are in demand principally by the feeding trade and the market is quite firm. Tankage and blood are both quoted at $9.50 per unit of ammonia ($11.55 per unit N) in Chicago, and $10.00 per unit ($12.15 per unit N) in New York. Offerings are quite limited, while no prompt bone meal seems to be obtainable.

Fish Scrap.—No apparent change in the market, with menhaden meal still quoted at $140.00 to $145.00 per ton, and scrap at $130.00. Supply is limited.

Phosphate Rock.—Production continues well equal to the demand, which shows some improvement.

Superphosphate. — Shipments are moving more freely, though the shortage of nitrogen tends to cut down the current demand for superphosphate.

Potash.—Domestic production is shipped out as mined, thus preventing any accumulation of stocks. Schedules are reported up to date. German production is said to be increasing rapidly.

CHARLESTON

Fertilizer Tonnage Limited by Nitrogen Shortage. Feed Organics Higher. Superphosphate Stocks Ample for Demand.

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, December 20, 1948.

Mineral nitrogen continues considerably short of demand, thereby limiting the output of mixed fertilizers. Potash movement to mixers is on schedule but in insufficient quantity to satisfy all demands. Superphosphate is in easy position with reference to supply.

Organics.—Recent rises in certain organics suitable for feed have been caused by demand from the feed trade. However, interest in fertilizer organics has been exceedingly slack. Domestic nitrogenous continues at prices around $3.50 to $4.00 per unit of ammonia ($4.25 to $4.86 per unit N) in bulk, f.o.b. sellers' works, depending on the location of the producer. Foreign organics are too high in price for domestic purchases.

Castor Pomace.—The market is nominally $27.50 per ton in bags, f.o.b. eastern production point, and movement is primarily against existing contracts.

Dried Ground Blood.—The New York market is slow with price level around $9.75 per unit of ammonia ($1.85 per unit N). The

Chicago market is inactive and nominally at $9.50 to $9.75 per unit of ammonia ($11.55 to $11.85 per unit N).

Potash.—Domestic price schedules remain the same and supplies are moving forward on schedule. Demand continues in excess of supply, however.

Phosphate Rock.—It is reported that the domestic demand is showing a fair increase. Supplies are being produced to easily meet the demand. Prices are steady.

Superphosphate.—Shipments to mixers have shown some improvement over November but stocks are plentiful.

Sulphate of Ammonia.—A shortage of stocks continues and demand heavier than supply prevails. No recent change in producers' prices has been noted.

Ammonium Nitrate.—Shortage in supplies continues to hold this market in a tight position.

Nitrate of Soda.—Settlement of the longshoremen's strike on both coasts has facilitated the movement of imported nitrate of soda, but demand continues in excess of supply.

CHICAGO

Good Demand for Feeding Organics. Some Price Increases Reported

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, December 20, 1948.

There is a continued demand for animal ammoniates and feeds with prices holding up fairly well in line with our last letter. Meat scraps are selling all the way from $105 to $110 per ton depending upon the seller and point of production. This item is moving right along at a normal rate.

The demand for digester tankage continues good and production is just about keeping up to the demand so that prices are holding steady at $110 to $123, again depending upon location and producer. Dry rendered tankage is quoted at $1.90 per unit of protein and is moving continually at this price; the supply at the present time is a bit short, but the demand also has fallen off to some degree.

The market on dried blood is about $9.75 per unit of ammonia ($11.85 per unit N), some moving at this price. Wet rendered tankage is unchanged at $9.25 to $9.50 per unit of ammonia ($11.24 to $11.55 per unit N), with no reported movement of this material.

Steamed bone meal and raw bone meal are just about unchanged at $65 per ton although some are holding steamed bone meal at $70 per ton.

International Expects Good Year

BY LOUIS WARE

President, International Minerals and Chemical Corporation

Although the world food supply situation is not as critical as it was at this time last year, the urgent need for full-scale food and feed crop production will continue through 1949 and several years to come.

Farmers are prosperous and are using increasing amounts of mixed fertilizers. Consequently, International Minerals and Chemical Corporation has been operating its phosphate and potash mines and its plant food division at capacity throughout 1948 to meet their needs and expert demand.

In May the corporation opened its new Noralyn phosphate mine and processing plant near Bartow, Florida. This is the world's largest and most modern phosphate mine and, with its processing facilities, it enables International to produce as much phosphate as was represented by the entire

output of all companies in the Florida phosphate fields before the war.

During the past year we have also constructed new fertilizer mixing plants at Winston-Salem, N. C., and Somerset, Ky., and sulphuric acid plants at Lockland, Ohio, and Spartanburg, S. C.

In line with our policy of product diversification, we are constructing a million-dollar refinery in Carlsbad, N. M., to produce potassium chloride and potassium sulphate for sale to chemical manufacturers. This new plant will allow the company to enter new chemical markets. It is expected to be in operation by next February.

Our fiscal year ending June 40, 1948, was the best year the corporation has ever had. Net sales showed an increase of 21 per cent over sales of the preceding year and an increase of 46 per cent over sales for the fiscal year ending June 40, 1946.

We believe earnings for the current fiscal year will be at least as good as last year, and possibly somewhat better. On the basis of earnings for the first quarter of this fiscal year the corporation increased its quarterly dividend rate on common stock from 40 cents to 50 cents a share.

Our research activities have been expanded during 1948 and we are obtaining some interesting and successful results. We are continuing test work on fertilizers and other studies in collaboration with various experimental stations throughout the country. Other research on various phases of our operations is carried on in laboratories at several of our plants.

Management of our corporation fully concurs with government and financial experts who have recently expressed their belief in the stability of the business outlook for 1949 and International is looking forward to making its contribution to our domestic and world economy during that year.

Changes in St. Regis Paper Company Officers

Directors of St. Regis Paper Company at a meeting on December 15th acted on a number of executive changes. Following the meeting, announcement was made that Roy K. Ferguson would assume the position of the chairman of the board, which has been vacant, and would also continue to act as president.

James H. Allen, a director, and president of the company's subsidiaries, Florida Pulp and Paper Company and the Alabama Pulp and Paper Company, was named to the newly created position of vice-chairman of the board.

Announcement was also made of the resignations of Carl B. Martin and Lyman A Beeman as vice-presidents and the appointments of Benton R. Cancell and William R. Adams as vice-presidents.

Mr. Martin will continue as a director and will be employed by the company in a consulting capacity. He plans to establish his own office at Watertown, N. Y.

Mr. Beeman, who has been in charge of manufacturing in the Printing, Publication and Converting Paper Division, will continue to act in an advisory capacity but will devote his major attention to the affairs of Finch, Pruyn & Company, Glens Falls, N. Y., of which he is now vice-president.

New Forms of Nitrogen 15 Available

Eastman Kodak Company has announced the availability of Nitrogen 15 in the form of either nitric acid or potassium nitrate. The company has been supplying N 15 in the form of ammonium salts and as potassium phthalamide in concentrations up to 60 atom per cent N 15. The ammonium nitrate has N 15 only in the ammonium radical, not in the nitrate.

Dr. Cyril J. Staud, director of Kodak Research Laboratories, said that for much research in agricultural chemistry scientists desire to follow the course of nitrate, in plants, it being one of the chief forms of fertilizer nitrogen. Some research workers have prepared nitrates from Kodak ammonia, usually by biological oxidation, but in general the process has been time-consuming.

The compounds now available, he pointed out, will reduce the number of steps involved. They may prove useful also in study of ex-

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PROVEN LOW PRICE! Ruggedly built of standard 10′ sections . . . eliminates high cost of custom-built installation. Production line savings are passed on to you!

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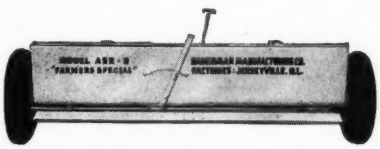
Two "HI-SPEED" portable conveyors to load and unload cars and trucks. Both handle large volumes efficiently and with dispatch . . . reduce manpower requirements. Write for full information on the Baughman Model 164 OPEN TROUGH BELT CONVEYOR and the Model Q SCREW CONVEYOR.

. . . and spreaders to meet any requirement!



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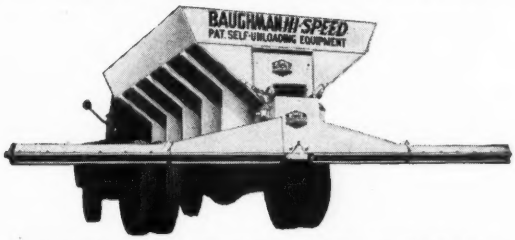

COMMERCIAL OPERATORS MAKE MONEY with this Baughman Self-Unloading Body. Speedily spreads large quantities of phosphate with Model 0-2 Phosphate Spreader. Spreader easily detached for spreading lime, unloading and spreading road rock, delivering coal and grain, etc. Thousands in use.

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plosives and in the synthesis of organic nitro compounds and derivatives.

Dr. Staud said nitric acid will be supplied as an aqueous solution containing at least two moles of HNO_3 per liter. The potassium nitrate will be sold as a dry solid.

Inquiries may be directed to the company's Organic Chemical Sales Division.

Indiana Corn Champions Use Adequate Fertilizer Treatment

Outstanding corn crops by two Indiana farmers is reported in *Prairie Farmer*. One of these, Harry Gene Lafuse of Union County, is just out of high school and helps his father in their corn-hog enterprise. Heavy fertilization and increased plant population were the means used to produce a crop on 5½ acres which is averaging 184 bushels to the acre. After plowing under a seven-year-old alfalfa crop, 325 pounds of a 3–12–6 fertilizer was spread and worked into the soil.

Lafuse planted his corn in 20-inch rows. A regular planter set for 40-inch rows was used. Then the rows were straddled and planted again. Corn was dropped at 14-inch intervals and 200 pounds of 3–12–12 was drilled in the rows with it. Seed was U. S. 13.

"We sacrificed ear size, but produced more ears which made more total bushels. Some stalk breakage was noted, but that didn't make any difference since hogs were used to harvest the corn," Lafuse stated.

Forty-inch rows are easily cultivated, but when they are narrowed to 20 inches it might become a problem. Lafuse solved the problem by using a one-wheeled garden tractor and small garden cultivator. The only drawback to such methods was the labor requirement since it meant walking through every middle row. Weeds were hoed from the rows when the corn was shoulder high.

With this crop, he won the State championship of the junior 5-acre corn contest conducted by the Indiana Corn Growers Association.

The adult championship was won by Charles Swallow, of Wayne County, with an official yield of 180.9 bushels per acre. His contest field had been in bluegrass for five years and had received an annual application of 100 pounds of nitrogen in the spring and 100 pounds of superphosphate in the fall.

He planted his corn in 40-inch rows. The planter was set to drop a kernel every 11 inches. The crop was planted May 18th. Fertilizer used was 225 pounds of mineralized 3–18–9 per acre in the row. His 813 hybrid seed was planted three inches deep to place them down where there was plenty of moisture. Summer cultivations included twice over with the rotary hoe and cultipacker and three times with the corn plow. Shallow cultivations were used.

American Cyanamid Announces New Staff Appointments

The Agricultural Chemicals Division of American Cyanamid Company has announced the following additions to their staff:

Peter J. Hahn as agriculturist in the Northeastern states.

Edward H. Wilson as agriculturist in Georgia, Alabama and Florida.

William E. Zimmerman as agriculturist, specializing in the control of crab grass in turf with Aero Cyanate Weedkiller.

Thomas J. White as sales representative working in the Midwest.

Donald Kelly, also a sales representative, working in the Midwest.

Soil Reaction Influences Nutrient Availability

"How Soil Reaction Affects the Supply of Plant Foods" is the title of Virginia Extension Bulletin 136. This bulletin exhibits a useful chart for showing the relation of soil reaction to the availability of plant nutrients to crops. To summarize the chart in terms of farming practices, it is now apparent that

intense acidity is accompanied by decreases in availability of such important plant foods as nitrogen, phosphorus, calcium, and magnesium. Acidity also favors increases in availability of aluminum, iron, and manganese to the point where these elements may become injurious to crops. Here then are two very good reasons why high degrees of acidity should be avoided in general farming practices. On the other hand, it is also apparent that soils can be overlimed. Phosphates, potassium, manganese, and iron usually become less valuable when alkalinity becomes relatively intense. The chart really shows, therefore, that the extreme reactions should be avoided and that the availability of plant foods is generally most favorable to crops when the soil reaction is between *p*H 5.5 and 7.0.

Bagpak Appoints Second Atlanta Sales Manager

International Paper Company's Bagpak Division has appointed Cedric Crain as its second district sales manager in Atlanta, Ga. Mr. Crain and Richard A. Port, the first district sales manager, are located in Bagpak's branch sales office at 56 Marietta Street, Atlanta.

The appointment of a second district sales manager has been necessitated by Bagpak's expanding business in the Atlanta territory.

Bagpak's other eleven branch sales offices are located in Baltimore; Baxter Springs, Kans.; Boston; Chicago; Cleveland; Los Angeles; New Orleans; Philadelphia; Pittsburgh; St. Louis; and San Francisco. Bagpak's head office is in New York City.

Standard Completes New Contact Acid Plant in Baltimore

The largest single unit, sulphur-burning contact sulphuric acid plant ever built was placed in operation December 14th at the Standard Wholesale Phosphate and Acid Works in Baltimore, Md. The new unit, capable of producing more than 500 tons of sulphuric acid per day, was designed and built by Chemical Construction Corporation, a unit of American Cyanamid Company.

Standard entered the acid producing field in 1913 at which time they produced only chamber process acid. In 1927 Chemical Construction Corporation designed for them a 50-ton per day sulphuric acid plant which was the first contact sulphuric acid plant in the world to use the wel-known Selden Vanadium Catalyst. An 80-ton plant and a 120-ton plant followed in the next year. Greatly increased wartime demand resulted in a 200-ton plant in 1941 and a 300-ton plant in 1943. All of these contact process plants were Chemical Construction Corporation projects.

THE FATE OF PHOSPHATE SOIL SUPPLEMENTS

(Continued from page 9)

the difference in *p*H value made less difference in the absorption of phosphorus.

Attention might be called to the fact that although the above factors are extremely important in the availability of phosphates, drainage and microbiological activities are also factors.

(To be continued in the next issue)

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Wilson & George Meyer Building New Warehouse in Los Angeles

Wilson & George Meyer & Company, Pacific Coast distributors of agricultural and industrial chemicals, is constructing a $150,000 warehouse and office building to serve its customers in Southern California, Arizona, Utah, Colorado and New Mexico.

The new building will be located in the heart of the Los Angeles central manufacturing district at District Boulevard and Gifford Avenue. It will contain 10,200 square feet of floor space, of which 3,000 square feet will be used for offices to accommodate a staff of fifteen people. In addition to a railroad spur track the new warehouse will have ample and sufficient loading and unloading facilities for trucks. Also space has been provided for convenient customer parking.

THE TVA AND THE FERTILIZER INDUSTRY

(Continued from page 11)

nation's annual production. The rest comes from Florida. Freight and other distribution costs largely explain this situation. The cost of the long hauls between phosphate ore deposits and the areas that need the soil minerals must be reduced. One way to reduce shipping costs is to increase the concentration of the product.

Calcium Metaphosphate

TVA's calcium metaphosphate, with over 60 per cent of P_2O_5, is a made-to-order fertilizer tool designed to break that bottleneck of distribution costs, open up the barely scratched western deposits, and underwrite the future of the most important agricultural producing area of America. That is its purpose and its promise. Whether this new product will fulfill that promise, only research will tell—research in its use and research in its production.

We are making progress on both ends of the research. During the last fiscal year over 5,000 tons of calcium metaphosphate were spread on several hundred farms in a score of states. The large pilot plant that produced this material will soon be succeeded by an industrial-scale demonstration plant using a greatly improved process. Meanwhile from the field are coming hundreds of reports describing what happens when calcium metaphosphate is introduced into farm and farm

community improvement programs under varied conditions of soil and climate. Thus far the evidence shows that calcium metaphosphate is excellent when used on soils in the humid belt; it is less effective than triple superphosphate on the high lime soils of the Dakotas, Nebraska, and parts of Kansas and Iowa.

Thorough Research

In the TVA Act you will find some very specific language in the section dealing with fertilizer. We are instructed not just to produce new and better fertilizers but to get them used in better ways and in larger amounts. That means, as we interpret it, that a fertilizer product can be considered successful when its value exceeds its cost to the farmer. Its value must be demonstrated by successful use in sound systems of farming. The quantities used by the farmer must be sufficient to build and maintain the soil; and the demand from farmers using the product must be sufficient to provide a steady outlet for the production of at least one plant operating at a practicable industrial scale. Only when that point is reached and industry begins to adopt the process—only then can our research be said to have attained its object. For example, when and if calcium metaphosphate is thoroughly tested and its value demonstrated so that some private agency begins to produce it to supply the demand we have stimulated, we will then begin to try out another product, developed from the laboratory and pilot plant.

Success in fertilizer research is not to be had overnight. It takes years of time and the combined energies of thousands of people to carry through the research and demonstration job on a single new fertilizer product. And there must be many new products. There will probably never be a universal fertilizer; we have too many kinds of soil in this country, too many climates, too many types of farming, and too wide a range of economic and other variables. That is why we now have at various stages of laboratory and pilot plant development at least a half dozen processes for producing high-analysis phosphatic and double nutrient nitrogen-phosphate fertilizers. Our engineers consider at least two of these products to be almost as promising as calcium metaphosphate.

For years we have enjoyed cordial and mutually helpful relations with the technical personnel of the industry. Your engineers talk the same language and use the same slide rules as ours do. They visit us at Muscle Shoals, and are encouraged to inspect these public plants and laboratories. Frequently they ask for blueprints and specifications and usually they get what they ask for. They tell us and write us that our research has been useful to them. Recently they have begun to prove this by utilizing our technical developments and processes in whole or in part.

If more of the fertilizer and chemical industries will study the results and discoveries of this research—as some of you are doing—and if you can adopt and adapt these results in your program to expand production, we believe you may put yourself in a position for the first time to serve adequately the tremendous, the almost unlimited soil fertility needs and requirements of the nation's breadbasket—the Central West.

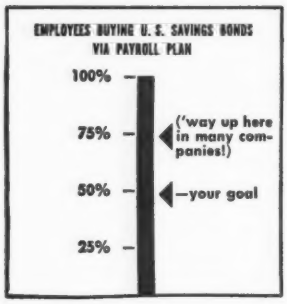
Common Problems

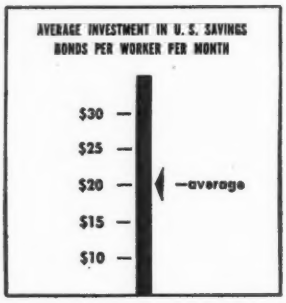
The problems on which the TVA is working at Muscle Shoals are your problems and the nation's problems. They are problems that involve the future of the nation's agriculture and the security and survival of our people.

If these problems are to be solved, if the fertilizer needs of the Central West are to be supplied and the western phosphate reserves are to be utilized, it will take the best efforts of industry and government to do it. When I say government I do not mean just the TVA; the land-grant colleges, the extension services, and many other agencies of government are committed to the solution of these problems.

Here then I think is where we find a natural and hopeful ground for agreement and cooperation with your industry. For its part the TVA is wholly committed to a cooperative policy with industry, with farmers, and with other agencies of government. There are great and challenging tasks ahead. I think it is our mutual duty and obligation to work together and approach these tasks with courage and imagination.

How is YOUR company doing in this "EVERYBODY-BENEFITS" plan?





If the figures for your company fall below those shown above, you're missing your share of benefits of the Payroll Savings Plan! Nation-wide experience proves that when top management puts the "OK" on the Plan, its benefits rise sharply.

Benefits to *Employees*—Every $3 invested in Savings Bonds pay $4 at maturity. Workers gain (1) the means to buy in the future more of the things they will want; (2) the peace of mind that goes with regular saving.

Benefits to *Employers*—Participation in Payroll Savings makes workers more contented. Worrying less, they work better. Among the more than 20,000 large companies with Payroll Savings, records show that worker production increases, absenteeism and accidents decrease as payroll savings participation rises.

Benefits to the *Nation*—The Payroll Savings Plan is a powerful deterrent to inflationary forces. Every Savings Bond dollar built up in the Treasury withdraws a dollar from the swollen spending stream, aiding national security.

What can *You* do?—If your company has the Payroll Savings Plan, make sure it's adequately promoted by your top executives.

If you haven't yet installed the Plan, why pass up its benefits any longer? All the help you need is available from your State Director, Savings Bonds Division, U. S. Treasury Department. Call him today!

The Treasury Department acknowledges with appreciation the publication of this message by

THE AMERICAN FERTILIZER

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council

BUYERS' GUIDE • A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

AMMONIA—Anhydrous and Liquor
Commercial Solvents Corp., New York City
Spencer Chemical Co., Kansas City, Mo.

AMMONIUM NITRATE
Lion Oil Co., El Dorado, Ark.
Spencer Chemical Co., Kansas City, Mo.

BAG MANUFACTURERS—BURLAP
Bemis Bros. Bag Co., St. Louis, Mo.
Chase Bag Co., Chicago, Ill.
Fulton Bag & Cotton Mills, Atlanta, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAG MANUFACTURERS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.
Chase Bag Co., Chicago, Ill.
Fulton Bag & Cotton Mills, Atlanta, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

BAG MANUFACTURERS—Paper
Bemis Bro. Bag Co., St. Louis, Mo.
Chase Bag Co., Chicago, Ill.
Fulton Bag & Cotton Mills, Atlanta, Ga.
Hammond Bag & Paper Co., Welisburg, W. Va.
International Paper Co., Bagpak Div., New York City
Jaite Company, The, Jaite, Ohio
Raymond Bag Co., Middletown, Ohio
St. Regis Paper Co., New York City

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Huber & Company, New York City
McIver & Son, Alex. M., Charleston, S. C.

BAG CLOSING MACHINES
St. Regis Paper Co., New York City
Union Special Machine Co., Chicago, Ill.

BAG PRINTING MACHINES
Schmutz Mfg. Co., Louisville, Ky.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, The, East Point, Ga.
St. Regis Paper Co., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston, Mass.

BONE BLACK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Huber & Company, New York City

BONE PRODUCTS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

BUCKETS—For Hoists, Cranes, etc.
Hayward Company, The, New York City

BUCKETS—Elevator
Baughman Manufacturing Co., Jerseyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARS AND CARTS
Atlanta Utility Works, The, East Point, Ga.
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHEMICALS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Commercial Solvents Corp., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Lion Oil Company, El Dorado, Ark.
McIver & Son, Alex. M., Charleston, S. C.
Spencer Chemical Co., Kansas City, Mo.
Virginia-Carolina Chemical Corp., Richmond, Va.
Woodward & Dickerson, Inc., Philadelphia, Pa.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Company, Inc., Savannah, Ga.
Wiley & Company, Baltimore, Md.

CONDITIONERS
Arkansas Rice Growers Corp. Assn., Stuttgart, Ark.
Jackle, Frank R., New York City
Keim, Samuel D., Philadelphia, Pa.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

CYANAMID
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City

DRYERS
Sackett & Sons Co., The A. J., Baltimore, Md.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

FERTILIZER (Mixed) MANUFACTURERS
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Corporation, Baltimore, Md.
International Minerals & Chemical Corporation, Chicago, Ill.
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Virginia-Carolina Chemical Corp., Richmond, Va.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Machine Works, Aurora, Ind.

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Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Southern States Phosphate & Fertilizer Co., Savannah, Ga.
Woodward & Dickerson, Inc., Philadelphia, Pa.

INSECTICIDES
American Agricultural Chemical Co., New York City

LEAD BURNERS
Southern Lead Burning Co., Atlanta, Ga.

LIMESTONE
American Agricultural Chemical Co., New York City
Ashcraft-Wilkinson Co., Atlanta, Ga.
McIver & Son, Alex. M., Charleston, S. C.

LOADERS—Car and Wagon
Hough Co., The Frank G., Libertyville, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making and Handling
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Ammoniating
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, The, East Point, Ga.
Baughman Manufacturing Co., Jerseyville, Ill.
Hough Co., The Frank G., Libertyville, Ill.
Hayward Company, The, New York City
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, The, East Point, Ga.
Bradley Pulverizer Co., Allentown, Pa.
Kent Mill Co., Brooklyn, N. Y.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Material Handling
Atlanta Utility Works, The, East Point, Ga.
Baughman Manufacturing Co., Jerseyville, Ill.
Hayward Company, The, New York City
Hough Co., The Frank G., Libertyville, Ill.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Mixing, Screening and Bagging
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MACHINERY—Power Transmission
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MACHINERY—Superphosphate Manufacturing
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

MANGANESE SULPHATE
McIver & Son, Alex. M., Charleston, S. C.

MINOR ELEMENTS
Tennessee Corporation, Atlanta, Ga.

MIXERS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.

NITRATE OF SODA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.

NITROGEN SOLUTIONS
Lion Oil Company, El Dorado, Ark.
Spencer Chemical Co., Kansas City, Mo.

NITROGENOUS ORGANIC MATERIAL
American Agriculture Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

NOZZLES—Spray
Monarch Mfg. Works, Philadelphia, Pa.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Virginia-Carolina Chemical Corp., Richmond, Va.

PLANT CONSTRUCTION—Fertilizer and Acid
Atlanta Utility Works, The, East Point, Ga.
Chemical Construction Corp., New York City
Monsanto Chemical Co., St. Louis, Mo.
Sackett & Sons Co., The A. J., Baltimore, Md.
Southern Lead Burning Co., Atlanta, Ga.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Company, Boston, Mass.
Titlestad Corporation, Nicolay, New York City

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City

POTASH SALTS—Manufacturers
American Potash and Chem. Corp., New York City
Potash Co. of America, New York City
International Minerals & Chemical Corporation, Chicago, Ill
United States Potash Co., New York City

PRINTING PRESSES—Bag
Schmutz Mfg. Co., Louisville, Ky.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.

REPAIR PARTS AND CASTINGS
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

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SCALES—Including Automatic Bagging
Atlanta Utility Works, The, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCREENS
Atlanta Utility Works, The, East Point, Ga.
Link-Belt Co., Chicago, Ill.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind
Sturtevant Mill Company, Boston, Mass.

SEPARATORS—Air
Kent Mill Co., Brooklyn, N. Y.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.

SULPHURIC ACID
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
McIver & Son, Alex. M., Charleston, S. C.
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, G.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davison Chemical Corporation, Baltimore, Md.
Huber & Company, New York City
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
Southern States Phosphate Fertilizer Co., Savannah, Ga.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Minerals & Chemical Corporation, Chicago, Ill.
U. S. Phosphoric Products Division, Tennessee Corp., Tampa, Fla.
Virginia-Carolina Chemical Corp., Richmond, Va.

TAGS
Keener Mfg. Co., Lancaster, Pa.

TANKAGE
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City
Davidson Commission Co., The, Chicago, Ill.
International Minerals & Chemical Corporation, Chicago, Ill.
Jackle, Frank R., New York City
McIver & Son, Alex. M., Charleston, S. C.
Woodward & Dickerson, Inc., Philadelphia, Pa.

VALVES
Atlanta Utility Works, The, East Point, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

Alphabetical List of Advertisers

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1. Quality . . . our Red Indian products are of unquestioned excellence.
2. Service . . . we make every effort to give you the service you want and deserve.

When better service is possible be assured P. C. A. will give it. Meanwhile your confidence, and your patience are greatly appreciated.

POTASH COMPANY OF AMERICA

CARLSBAD, NEW MEXICO

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SOUTHERN SALES OFFICE . . Candler Building, Atlanta, Ga.

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That's why his success in fertilizing for larger yields of quality crops is as important to us as it is to you.

That, too, is why so many fertilizer manufacturers regularly depend on International for their supplies of potash. They have found that the quality and mechanical condition of *International Potash* enable them to produce plant foods which give farmers excellent results year after year.

International Potash is mined and refined at Carlsbad, New Mexico. It is prepared in the grades you need to produce the variety of fertilizer your farm customers want. You'll find that the clean, dry crystals and free-flowing characteristics of *International Potash* will save you time and money in manufacturing operations—and will help you produce a quality product which you are proud to identify with your trade name.

SUL-PO-MAG (Water-Soluble Double Sulfate of Potash-Magnesia) • MURIATE OF POTASH • SULFATE OF POTASH

SUL-PO-MAG TRADEMARK REG. U. S. PAT. OFF.

Potash Division • International Minerals & Chemical Corporation

MINERALS International CHEMICALS

General Offices: 20 North Wacker Drive, Chicago

end